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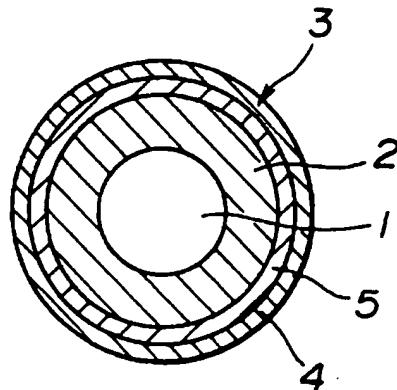
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## (54) Wound golf ball

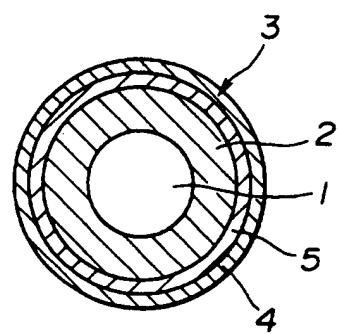
(57) In a wound golf ball comprising a liquid center (1), thread rubber (2), and a cover (3), the cover has a multilayer structure including an outer layer (4) and an inner layer (5) having a higher hardness than the outer layer. The outer layer (4) is 0.4 - 3.0 mm thick. The ball affords improved spin and flying distance and is fully durable.

FIG.1



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**FIG.1**

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Wound Golf Ball

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This invention relates to a thread wound golf ball which is durable while affording a satisfactory flying distance and controllability.

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Prior art thread wound golf balls with a solid center have two types of covers, that is, ionomer resin covers and balata rubber covers. For simplicity, the thread wound golf balls having a cover of ionomer resin are referred to 20 as wound ionomer balls while the thread wound golf balls having a cover of balata rubber are referred to as wound balata balls. They have advantages and disadvantages. The wound ionomer balls are superior in flying distance when struck with the driver, but considerably inferior in spin 25 properties in the approach play on the green, that is, stoppage on the green. The wound balata balls are less durable, for example, in that their cover at the ball surface can be scuffed or fretted by bunker shots and cut when topped with iron clubs.

30 For the purpose of improving spin property and durability, a wound golf ball using a softer ionomer resin as the cover was also proposed. This ball has problems that it has little difference in the flying distance associated with the driver from the conventional wound golf 35 balls and that it can be cut in the cover when topped with iron clubs as are the wound balata balls.

It would be desirable to provide a wound golf ball which is satisfactory in flying distance and spin property and is fully durable.

5       The present invention relates to a thread wound golf ball having a center ball, thread rubber, and a cover. The cover has a multi-layer structure including an outer layer and an inner layer. The inner layer has a higher hardness than the outer layer. The outer layer has a radial 10 thickness of 0.4 mm or more. Our work shows that such a ball may attain a flying distance at least comparable to that of the conventional wound ionomer balls having a cover of high hardness ionomer resin. Its spin property may compare with that of the conventional wound balata balls. Its cover is 15 not readily cut when topped with iron clubs.

Although two-piece solid golf balls having a cover of two-layer structure are known in the art as disclosed in Japanese Patent Application Kokai (JP-A) Nos. 80469/1985 and 290969/1986 and EP 577,058, a two-layer cover has never 20 been proposed for wound golf balls. The thread wound golf ball having a cover of the above-defined layer structure as proposed herein may afford the following 25 advantages. Since the cover outer layer has a lower hardness or adequate softness, the ball gains a high spin rate and offers good spin properties and controllability on approach shots. Since the cover inner layer has a higher hardness, the cover as a whole offers good repulsion or restitution, an increased initial velocity with a low spin rate, and an increased flying distance on driver shots. A 30 combination of the outer layer having a lower hardness with the inner layer having a higher hardness improves cut resistance and hence, durability. The outer layer formed of an ionomer resin having a lower hardness has higher scuffing resistance and hence, more durable than the balata 35 covers and high hardness ionomer resin covers.

According to the present invention, there is provided a wound golf ball comprising a center ball, a thread rubber layer, and a cover wherein the cover has a multi-layer

structure including an outer layer having a thickness of at least 0.4 mm and an inner layer having a hardness higher than that of the outer layer.

5

BRIEF DESCRIPTION OF THE DRAWINGS

The only figure, FIG. 1 is a schematic cross-sectional view of one exemplary wound golf ball.

10 Referring to FIG. 1, a wound golf ball is illustrated as comprising a spherical center ball 1. Thread rubber is wound on the center ball 1 to form a thread rubber layer 2, which is enclosed in a cover 3. According to the invention, the cover 3 has a multi-layer structure, 15 typically a two layer structure consisting of a radially outer layer 4 and a radially inner layer 5.

Each of the outer and inner layers 4 and 5 may be formed of a composition comprising a well-known cover resin such as ionomer resins and balata rubber and 20 conventional amounts of optional additives including pigments such as titanium white and dispersants such as magnesium stearate. The outer layer has a first hardness which is relatively low and the inner layer has a second hardness which is higher than the first hardness.

25 The outer layer is preferably with a Shore D hardness of 40 to 55, more preferably 45 to 51. Useful resins are ionomer resins, for example, Himilan® 8120, 8220 and 8320 commercially available from Mitsui-duPont Polychemical K.K. and mixtures of two or more of 30 them, as well as balata rubber.

The inner layer is preferably formed of a resin having a Shore D hardness of 55 to 68, more preferably 60 to 66. Useful resins are ionomer resins, for example, Himilan 1554, 1555, 1601, 1702, 1705, and 1706 commercially 35 available from Mitsui-duPont Polychemical K.K. and mixtures of two or more of them.

The difference in hardness between the inner and outer layer resins should preferably be at least 5, especially at least 10 in Shore D hardness.

According to the present invention, the outer layer 5 should have a radial thickness of at least 0.4 mm, preferably 0.4 to 3.0 mm, more preferably 0.4 to 2.0 mm. It is recommended that the outer and inner layers have a total thickness of 1.0 to 4.0 mm, especially 1.5 to 2.5 mm. If the total thickness is less than 1.0 mm, the cover may 10 be less durable against topping. If the total thickness is beyond 4.0 mm, the ball may be sometimes low in initial velocity. An outer layer of less than 0.4 mm fails to provide spin properties on approach shots. The ratio of the outer layer thickness to the inner layer thickness is 15 desirably from 3:7 to 7:3.

The wound golf ball of the invention may have either a liquid center or a solid center, which are both conventional. The liquid center typically consists of a rubber or center bag filled with a liquid. The rubber or 20 center bag may be formed of any well-known composition. Water is the preferred liquid. The fill liquid preferably has a specific gravity of at least 0.9, more preferably 1.0 to 1.5, most preferably 1.0 to 1.2. Fine powder, surfactant or the like may be added to water for adjusting 25 the specific gravity. The fine powder used herein is one which consists of fine particles and is not dissolved in water. Typical examples are fillers such as barium sulfate, zinc oxide, and silica. The powder preferably has a mean particle size of 0.02 to 100  $\mu\text{m}$ , especially 0.5 to 30 20  $\mu\text{m}$ . The powder may be blended in an amount of 4 to 60% by weight, especially 10 to 50% by weight of the fill liquid. Exemplary surfactants are dodecylbenzenesulfonic acid and sodium dodecylbenzenesulfonate. Water is the preferred liquid. The rubber or center bag may be formed 35 of any well-known composition. Also the solid center may be of a well-known composition.

The center ball preferably has an outer diameter of 27 to 32 mm and a weight of 15.0 to 23.0 g, especially 17.5 to 21.5 g.

5 The type of thread rubber wound on the center ball and the winding technique may be conventional.

After a core is formed by winding a thread rubber layer on the center ball, any desired technique may be used in enclosing the core in a cover of multi-layer structure.

For example, each covering composition is directly 10 injection molded around the core. Alternatively, a pair of hemispherical cups are formed from each covering composition and the core is surrounded by the dual cups, which is press molded at 110 to 160°C for about 2 to 10 minutes.

15 The golf ball is typically made with a diameter and weight meeting the Golf Association Standards, that is, a diameter of at least 42.67 and a weight of up to 45.92 g.

EXAMPLE

20 Examples of the present invention are given below by way of illustration and not by way of limitation.

Examples 1-5 and Comparative Examples 1-5

A liquid center was prepared by molding a rubber 25 composition of the formulation shown in Table 1 in a hemispherical mold cavity and vulcanizing it to form hemispherical shells. A pair of shells were mated to form a rubber bag which was filled with water. The center ball had an outer diameter of 29 mm and a weight of 18.8 g.

30

Table 1

Center bag A

Composition (pbw)

	Natural rubber	100
35	Stearic acid	1
	Zinc oxide	330
	Processing oil	30

	Vulcanization promoter	1.5
	Sulfur	2.5
<u>Physical properties as vulcanized</u>		
	Hardness, JIS A scale	60
5	Specific gravity	2.27
	Bag gage, mm	2.2

Thread rubber was wound on the liquid center ball by a conventional winding technique to form a thread rubber 10 layer of about 6 mm thick.

Each cover composition was prepared by blending 100 parts by weight of a resin as shown in Table 2 with 5 parts by weight of titanium oxide and 0.3 parts by weight of magnesium stearate in a twin screw extruder. The cover 15 composition was molded into hemispherical cups.

Table 2

	Ionomer resin (pbw)	Cover composition			
		R1	R2	R3	R4
20	H1557 (Zn)	25	-	-	-
	S8120 (Na)	50	-	-	-
	S8320 (Na)	-	65	90	-
	H1605 (Zn)	-	-	-	50
	H1650 (Zn)	-	35	10	-
25	H1706 (Zn)	-	-	-	50
	H1856 (Na)	25	-	-	-
	Cover resin hardness (Shore D)	51	47	41	64

A wound golf ball was prepared by combining a pair of 30 cups of one type with a pair of cups of another type in concentric overlap, mating a pair of dual cups so as to enclose the core therein, and compression molding the cups to form a cover.

Each of the thus prepared golf balls was tested for 35 carry, total distance (carry + run), spin, and elevation angle by hitting with the driver and sand wedge. The results are shown in Table 3. The ball was also examined

for cut durability by hitting with the sand wedge at a head speed (HS) of 36 m/s.

**Table 3**  
**Comparative Example**

Cover	Example					Comparative Example				
	1	2	3	4	5	1	2	3	4	5
Structure	2 layer	2 layer	2 layer	2 layer	1 layer	1 layer	1 layer	2 layer	2 layer	2 layer
Outer layer (Shore D)	R1 (51)	R2 (47)	R3 (41)	R1 (51)	R1 (51)	R4 (64)	R4 (64)	R1 (51)	R1 (51)	(48)
Inner layer (Shore D)	R4 (64)	R1 (51)	R4 (64)	R1 (51)	R4 (64)	(48)				
Thickness (mm)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	0.8	1.8
Thickness ratio* <sup>1</sup>	5:5	5:5	5:5	3:7	7:3	-	-	5:5	4:6	-
<hr/>										
Performance										
W#1, HS = 45 m/s										
Carry (m)	211.5	210.7	210.5	211.6	210.6	209.7	211.7	211.6	211.1	209.5
Total distance (m)	228.9	228.4	228.1	229.1	228.2	226.5	229.3	229.2	228.5	226.1
Spin (rpm)	2880	2910	2990	2860	2950	3070	2830	2840	2900	3100
Elevation angle (°)	11.5	11.5	11.6	11.5	11.5	11.7	11.5	11.5	11.5	11.8
W#1, HS = 50 m/s										
Carry (m)	240.9	240.8	240.8	241.0	240.7	240.7	241.4	241.2	240.7	240.1
Total distance (m)	258.2	257.8	256.0	258.4	257.5	255.1	258.5	258.4	257.7	254.8
Spin (rpm)	2780	2800	2860	2760	2820	3000	2710	2720	2810	3050
Elevation angle (°)	11.4	11.4	11.5	11.4	11.4	11.6	11.4	11.4	11.4	11.7
SW, HS = 20 m/s										
Spin (rpm)	6150	6250	6480	6130	6240	6250	4570	4590	6050	6300
Cut durability* <sup>2</sup>				-	-					
SW, HS = 36 m/s	0/30	-	-	-	-	8/30	0/30	-	30/30	-

\*1 Thickness ratio is outer layer thickness/inner layer thickness.

\*2 The number of balls with cover failure or ball distortion from sphericity

It is evident that the wound golf balls embodying the invention are improved in flying distance and spin property and are fully durable.

Japanese Patent Application No. 201389/1994 and No. 5 333025/1994 is incorporated herein by reference.

Although some preferred embodiments have been described, many modifications and variations may be made thereto in the light of the above teachings. It is therefore to be understood that within the scope of the 10 appended claims, the invention may be practiced otherwise than as specifically described.

CLAIMS:

1. A wound golf ball comprising a center ball, thread rubber wound thereon, and a cover enclosing the wound center, wherein  
5       said cover has a multi-layer structure including an outer layer having a first hardness and a thickness of at least 0.4 mm and an inner layer having a second hardness higher than the first hardness.
- 10      2. A wound golf ball of claim 1 wherein the outer and inner layers of said cover have a total thickness of 1.0 to 4.0 mm and the outer layer has a thickness of 0.4 to 3.0 mm.
- 15      3. A wound golf ball of claim 1 or 2 wherein the outer layer of said cover is formed of a first resin having a Shore D hardness of 40 to 55, and the inner layer is formed of a second resin having a Shore D hardness of 55 to 68,  
20      the difference in hardness between the first and second resins being at least 5 in Shore D hardness.
- 25      4. A wound golf ball of any one of claims 1 to 3 wherein said center ball has an outer diameter of 27 to 32 mm and a weight of 15.0 to 23.0 g.
5. A wound golf ball of any one of claims 1 to 4 wherein said center ball is a liquid center.
6. A wound golf ball substantially as any described herein with reference to Examples 1 to 5.



The  
Patent  
Office

Application No: GB 9515947.1  
Claims searched: 1-6

Examiner: David Whitfield  
Date of search: 19 September 1995

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.N): A6D D1A D1B C3V VEM C3M MXC

Int CI (Ed.6): A63B 37/12

Other: ONLINE:- WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X:E	GB2280379A (LISCO) (WHOLE DOCUMENT)	1,4,5
X	GB2064338A (BRIDGESTONE) ( " " )	-
X	WO80/01541A1 (QUESTOR) ( " " )	-

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